

REMARKS

Claims 1-26 are pending in this application. Claims 1, 2, 4-6, 10, 11, 13, 14, 17, 19, and 24-25 are amended to clarify the claimed embodiments of the present invention. Claims 3, 9, 12, 15 and 16 are canceled. Claim 26 is added. The amendments do not add new matter and entry of the amendments at this time is proper. Favorable reconsideration and allowance of the present patent application are respectfully requested. The amendments, in conjunction with the following remarks, are believed to place the application in immediate condition for allowance.

Though claims 1, 2, 4-6, 10, 11, 13, 14 and 17, 19, and 24-25 are amended, Applicants do not concede that the Office Action's statutory rejections are proper. The amendments are understood to not narrow the scope of the claimed invention, nor have they been made for reasons related to patentability. Rather, the amendments are made to clarify embodiments of the claimed invention. Thus, in future construction or interpretation, the amended claims should be entitled to a full range of equivalents.

Office Action

Claim 2 stands rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Claims 11-13, 19 and 20-24 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,703,372 (Horsky et al.). Claims 1-

10, 14 and 17-18 stand rejected under 35 U.S.C. § 103(a) as allegedly rendered obvious by Horsky in view of U.S. Patent No. 5,350,969 (Gattuso). Claims 20-21 and 25 stand rejected under 35 U.S.C. § 103(a) as allegedly rendered obvious by Horsky. Applicants respectfully traverse the rejections in view of the foregoing amendments and the following remarks.

Applicants acknowledge with appreciation that the Office Action indicates the Information Disclosure Statement filed June 6, 2002, has been considered. Applicants also note that the drawings filed on June 6, 2002, are accepted by the Examiner.

Indefiniteness

Claim 2 is rejected as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Office Action alleges that insufficient antecedent basis exists for "second portion" in claim 2. Claim 2 is amended to correct the minor informalities. Thus, the indefiniteness rejection is rendered moot.

Further, Applicants disagree with the statutory rejection of claim 2. Claim 2 is amended to correct minor informalities without regard to the patentability of claim 2. Thus, claim 2, at most, is objectionable. Applicants maintain that the statutory rejection of claim 2 is improper and should be withdrawn.

Anticipation

Claim 11-13, 19 and 22-24 are rejected as allegedly anticipated by Horsky. The rejections are respectfully traversed.

To anticipate, the applied art must disclose each and every element of the claimed invention. Applicants submit that Horsky does not disclose each and every element of claims 11-13, 19 and 22-24.

Horsky describes an end cap mounted at one end of an inner tubular member of the cathode body of an indirectly heated cathode. The end cap is formed as one piece with a cylindrical part having ends 320 and 322. The cap has a radially outwardly extending rim 326. Rim 326 of the cap is pressed into a counterbored region of one end of inner tubular member 162 of cathode body.

The end cap of Horsky describes a single piece having central cylindrical body 324 and radial rim 326 that closes the end of the tubular member of the cathode body. According to Horsky, rim 326 is secured in the end of the tubular member of the cathode body with the interference fit in such a way as to provide a small area of contact between the end cap and the tubular member to minimize thermal transfer. Horsky, column 3, lines 4-8. Horsky, however, does not disclose a button member that comprises a collar piece and a slug piece shrink fit secured in the collar piece.

In contrast, claim 11 recites the button member includes a collar piece and a slug piece shrink fit secured in the collar piece, the slug piece providing respective central portions of the front and rear faces of the button member and the collar piece providing respective exposed surrounding portions of the front and rear faces. The button member includes a collar piece with a distinct slug piece that is shrink fit secured in the collar piece.

Thus, the slug piece and the collar piece were not formed as a single end cap as described in Horsky. The slug piece is secured and the collar piece provides respective central portions of the front and rear faces of the button member. The collar piece provides respective exposed surrounding portions of the front and rear faces. By making the slug piece and collar piece of separate parts so that the slug piece is shrink fit secured into the collar piece, it becomes possible to make the slug piece of a different material from the collar piece and/or to arrange for a thermal barrier between the slug piece and the collar piece.

Horsky does not disclose these features of the present invention because it is clear that the whole end cap of Horsky is formed as one piece. In Horsky, there is thermal barrier type interconnection between the outside edge of the rim of the end cap and the inner tubular member of the cathode body. In contrast,

claim 11 discloses a shrink fit interconnection provided between a slug piece and a collar piece. Applicants submit that the collar piece recited by claim 11 is not disclosed by inner tubular member 162 described in Horsky. According to claim 11, the collar piece provides respective exposed surrounding portions of the front and rear faces of the button member.

Thus, Horsky does not disclose each and every element of independent claim 11. Claims 12 and 13 depend from claim 11 and are allowable for the same reasons. Applicants respectfully request that the Examiner withdraw the anticipation rejections of claims 11-13.

With regard to claims 19 and 20-23, the Office Action alleges that Horsky shows a collar piece providing respective peripheral portions of the front and rear faces of the button member. Applicants respectfully disagree.

Applicants submit that inner tubular member 162 of Horsky does not disclose a peripheral portion of the rear face of the cap. In fact, inner tubular member 162 has no rear facing component at all but only a radially inward facing component adjacent to the rear of the cap. Further, inner tubular member 162 does not disclose a peripheral portion of the front face of the cap. Applicants submit that the exposed end face of inner tubular member 162 is not part of the cap described by Horsky. The exposed end face of inner

tubular member 162 of Horsky does not disclose a peripheral portion of the button member.

In contrast, claim 19 recites the button member comprising a collar piece and a slug piece secured in the collar piece, the slug piece providing respective central portions of the front and rear faces of the button member and the collar piece providing respective peripheral portions of the front and rear faces surrounding said central portions, the slug piece being secured in the collar piece so as to reduce thermal conduction from the slug piece to the collar piece and provide a temperature difference between the slug piece and the collar piece when the central portion of the rear face the button member is electron heated and used. Horsky does not disclose these features recited in claim 19. Further, Applicants submit that Horsky does not disclose a slug piece secured in a collar piece so as to reduce thermal conduction from the slug piece to the collar piece.

The only region minimizing thermal transfer described by Horsky is between the outer edge of rim 326 of the end cap and inner tubular member 162. Inner tubular member 162 does not disclose the claimed collar piece because inner tubular member 162 does not disclose peripheral portions of the front and rear faces of the button member. Referring to claim 19, the connection between the slug piece and the collar piece reduces thermal conduction from

the slug piece to the collar piece. This feature allows the central slug piece to become hotter in operation than the surrounding collar piece, thereby optimizing the generation of thermal electrons from the central portion provided by the slug piece of the front face of the button member.

The temperature of the surrounding collar piece may be relatively lower with corresponding reduced production of thermal electrons. When the indirectly heated cathode is used to generate an arc in the arc chamber of an ion source, the arc plasma can be concentrated immediately in front of the slug piece, so that erosion of the surrounding collar piece can be reduced. In addition, the thermal mass of the slug piece can be less than the thermal mass of the entire button member so that the temperature of the effective electron emitting cathode region can be controlled more precisely. Thus, claim 19 recites a button member for an indirectly heated cathode that is not disclosed by Horsky.

Therefore, Applicants submit that Horsky does not disclose each and every element of independent claim 19. Further, claims 22 and 23 depend from claim 19 and are allowable for the same reasons. Applicants respectfully request that the Examiner withdraw the anticipation rejections of claims 19 and 22-23.

Claim 14 is rejected as allegedly anticipated by Horsky. The Office Action alleges that Horsky describes reducing thermal

conduction from the claimed slug piece to the collar piece. Claim 24 recites subject matter similar to claim 19, discussed above. Thus, inner tubular member 162 of Horsky does not disclose the claimed collar piece. The claimed collar piece provides respective peripheral portions of the front and rear faces of the claimed button member. Inner tubular member 162 of Horsky does not disclose these portions of the front and rear faces, as discussed above with respect to claim 19. Applicants submit that claim 24 is distinguishable over Horsky for these reasons as well. Therefore, Applicants submit that Horsky does not disclose each and every element of independent claim 24. Applicants respectfully request that the Examiner withdraw the anticipation rejection of claim 24.

Obviousness

Claims 1-2, 4-8, 10, 14, 17-18, 20-21 and 25 are rejected as allegedly rendered obvious by Horsky in view of Gattuso. The rejection is respectfully traversed.

To establish obviousness, the Office Action must meet three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claimed limitations. MPEP

2143. Applicants respectfully maintain that the Office Action fails to establish obviousness.

As noted above, the applied art must teach or suggest all the claimed limitations. Applicants submit that neither Horsky nor Gattuso, either alone or in combination (assuming that the applied art may be combined, which Applicants do not admit), disclose or suggest all the claimed limitations. As discussed above, Horsky does not disclose or suggest a slug secured in a collar. The inner tubular member described by Horsky does not disclose or suggest the claimed collar as defined as providing peripheral portions of the front and rear faces of the button member. Further, Gattuso does not disclose or suggest those features of claim 1 that are missing from Horsky.

Gattuso relates to a cathode and cathode heater assembly particularly for use in thermionic emission type electronic devices. These devices include traveling wave tubes and other microwave devices, as described by Gattuso at column 1, lines 6-15. Gattuso does not disclose or suggest an indirectly heated cathode. In an indirectly heated cathode, the thermionic electron emitting button cathode is not heated ohmically, and does not receive heat by thermal conduction from a separate heat source.

The button member of an indirectly heated button cathode is heated by electron impact from an underlying filament that

negatively is biased relative to the cathode button member. By comparison, the cathode structure of Gattuso describes a cathode button 28 that is heated by direct thermal conduction from a cathode heater 10 braised to the back surface of the cathode button. Gattuso, however, does not disclose or suggest that an indirectly heated button cathode for an ion source.

In contrast, the claimed invention recites an indirectly heated button cathode for an ion source. The cathode assembly described by Gattuso is designed for use in an electronic microwave devices, including such devices for airborne applications, as described in column 1, lines 43-50. Gattuso describes a cathode heater assembly that can maintain an precisely controlled temperature of the cathode button so that its electronic emission properties do not vary. Column 1, lines 36-42. Variation in electron emission properties for cathode use in a microwave device is an unwanted source of "noise" in the device performance.

Further, Gattuso describes the cathode being used in a high vacuum environment in which there can be no substantial plasma density, or no substantial number of ions. Thus, in the electronic devices described by the button cathode of Gattuso, the cathode is not susceptible to bombardment of positive ions caused during sputtering and erosion of the cathode surface.

Applicants submit that in an ion source, a plasma containing both positive ions and electrons is created so that the negatively biased cathode surface is subjected to intense sputtering and erosion from positively charged ions in the plasma. Referring to Figure 3 of Gattuso, the cathode would be quite unsuitable as the button cathode of an ion source as disclosed by the claimed embodiments. Gattuso describes that the entire electron emitting surface of the cathode button is coated with a layer 30a of osmium.

In an ion source environment, such an osmium coating would be lost almost immediately by erosion from the plasma generated in the ion source. Thus, Gattuso does not disclose or suggest those features of the claimed invention missing from Horsky. Further, Applicants submit that one skilled in the art would not be motivated to combine Horsky with Gattuso because Gattuso is not relevant in the field of indirectly heated button cathodes for ion sources.

Applicants also submit that Gattuso does not disclose or suggest the features of amended claim 1 that the Office Action alleges are missing from Horsky. According to amended claim 1, the button member includes a central slug surrounded by a collar, with the slug forming the central portion of the front and rear faces of the button member in the collar forming peripheral portions of the front and rear faces. Thus, the slug providing the central portion

of the front face has a lower thermionic work function than the collar providing the peripheral portion of the front face. In Gattuso, the entire front face of the button member is coated with osmium to increase thermal emission. Gattuso does not disclose or suggest coating only a central part of the front face. Therefore, Applicants maintain that Gattuso does not disclose or suggest all the features claimed in amended claim 1. Applicants respectfully request that the Examiner withdraw the obviousness rejection of claims 1-2 and 4-8.

With regard to claims 9 and 10, claim 9 is deleted from the foregoing amendment. Claim 10 is made dependent upon new claim 26. Thus, the obviousness rejection of claims 9 and 10 is rendered moot. Applicants respectfully request that the Examiner withdraw the obviousness rejection to claim 10.

Claim 14 is rejected as allegedly rendered obvious by Horsky in view of Gattuso. Claim 14 recites a method claim that corresponds to amended claim 1, discussed above. Applicants submit that amended claim 14 is patentable for the same reasons discussed with regard to claim 1. Specifically, the applied art does not disclose or suggest all the claimed limitations of claim 14. Thus, Applicants respectfully request that the Examiner withdraw the obviousness rejection of claim 14.

With regard to claims 17 and 18, claim 17 is amended to recite subject matter similar to amended claim 1, such as defining the button cathode as including a collar and a slug secured in the collar, with the slug providing respective central portions of both the front and rear faces of the button member, and the collar providing respective peripheral portions of both the front and rear faces in the central portions. The slug is formed of material having a lower work function compared to the material of the collar. Further, claim 17 discloses an electron reflector also made of the lower work function material, and a magnet providing a magnetic field aligned between the button member and the head of the electron reflector. Thus, claim 17 is not disclosed or suggested by the applied art for the same reasons as set out above with regard to claim 1. Claim 18 depends from claim 17, and is allowable for the same reasons. Applicants respectfully request that the Examiner withdraw the obviousness rejection of claims 17 and 18.

With regard to claims 20 and 21, claims 20 and 21 depend from claim 19 and are allowable for the reasons set forth above. The Office Action, however, additionally rejects claim 21 as allegedly rendered obvious by Horsky. Claim 21 discloses that the collar piece has a central bore accommodating the slug piece and the inner end of the central bore has a reduced diameter with the slug piece

being shrink fit secured in this reduced diameter inner end of the bore. The Office Action alleges that the recited collar piece is disclosed or suggested by inner tubular member 162 of Horsky. Applicants respectfully disagree.

As discussed above, the recited collar piece is defined in claim 19 as providing peripheral portions of both the front and rear faces of the button member. Inner tubular 162 provides no such peripheral portions. According to Horsky, the entire cap member includes the unitary central cylindrical body 324 and rim 326 that is press fit in a countersunk end of inner tubular member 162. Applicants note that the countersunk end of cylinder 162 does not disclose or suggest a bore in the collar piece for the reasons discussed above. In addition, the countersinking of the end of inner tubular member 162 provides an enlarged diameter portion of inner tubular member 162, and not a reduced diameter part. Thus, Horsky does not disclose or suggest all the features of independent claim 19, and claim 21. Applicants respectfully request that the Examiner withdraw the obviousness rejection of claims 20 and 21.

Claim 25 is rejected as allegedly rendered obvious by Horsky. As discussed with regard to claim 21, Horsky does not disclose or suggest providing a collar piece and a slug piece for securing in the collar piece so that the slug piece provides respective central portions of the front and rear faces, and the collar piece provides

respective peripheral portions of the front and rear faces surrounding the central portions. The collar piece, as disclosed, has a central bore to accommodate the slug piece wherein the central bore has an inner and having a reduced diameter. Inner tubular member 162 of Horsky does not disclose or suggest the claimed collar piece because inner tubular member 162 does not provide peripheral portions of the front and rear faces. Further, as acknowledged by the Office Action, Horsky does not disclose or suggest cooling the slug piece in liquid nitrogen to shrink fit the slug piece in two the reduced diameter inner end of the bore and the collar piece. Therefore, Horsky does not disclose or suggest all the features of claim 25. Applicants respectfully request that the Examiner withdraw the obviousness rejection to claim 25.

New Claim

Applicants submit new claim 26 to advance additional embodiments of the present invention. Claim 26 recites subject matter similar to the independent claims discussed above. Applicants submit that claim 26 is allowable at least for the reasons given above.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact William F. Nixon (Reg. No. 44,262) at the

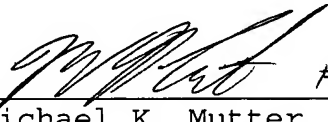
Appl. No. 10/091,351

telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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